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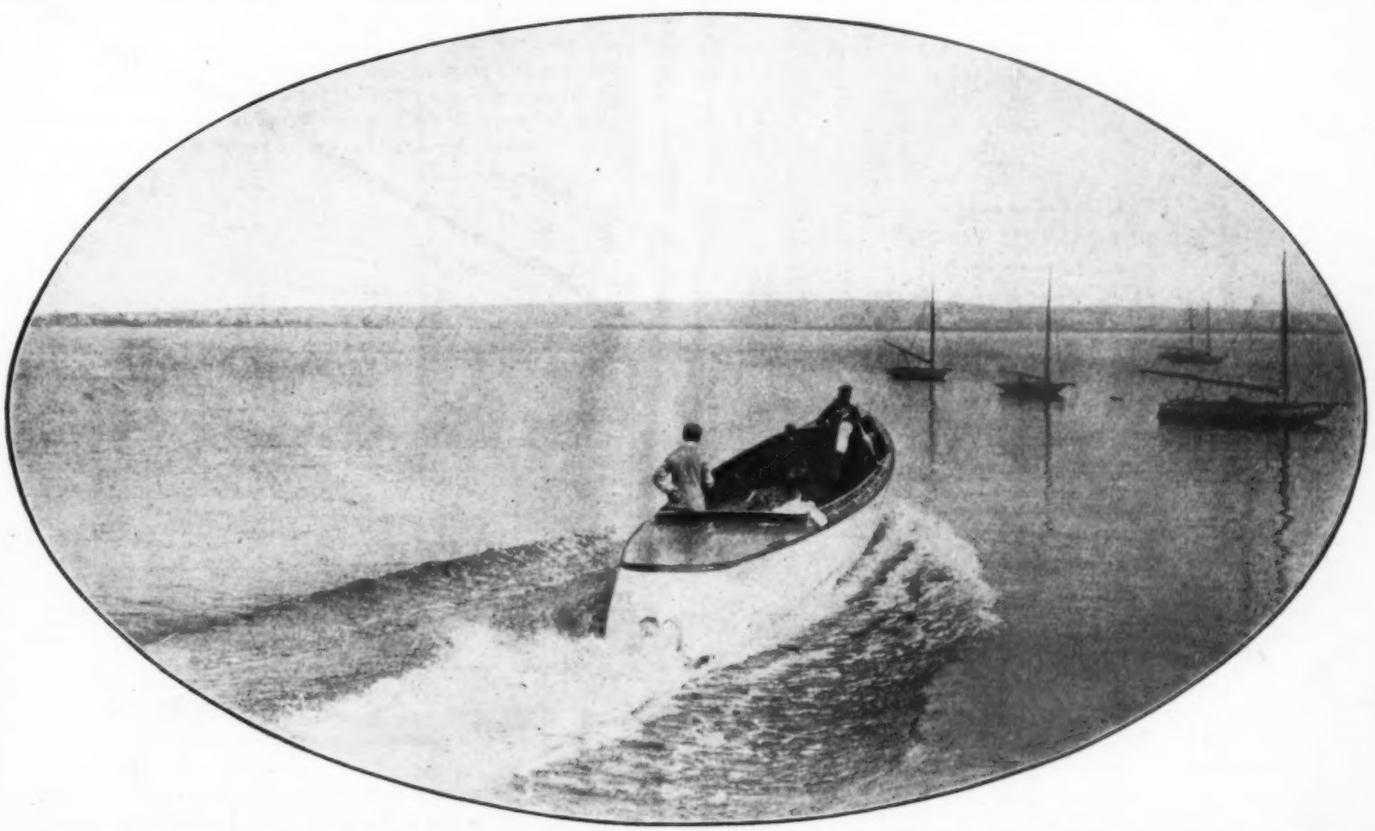
POPULAR MECHANICS

An Illustrated Weekly Review of the Mechanical Press of the World

"Tells you how to do things." Written so you can understand it

Vol. 2. No. 25. CHICAGO, DECEMBER 20, 1902. PRICE 5 CENTS.

Fastest Gasoline Launch in America



Swift "Automobile of the Lakes," Skims Through the Water With the Speed of a Train on Land.

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Shop Notes—Water Level Alarms—How to Write Inscriptions on Metals—Microscope to Determine Heat in Steel Making—Tin Pans to Protect Set Screws—Shading Marks on Drawings—How and Why the Injector Works—Machinery Creates Occupations.

SWIFT "AUTOMOBILE OF THE LAKES."

Fastest Gasoline Launch in America Built at Syracuse, N. Y.—Expected to Make 30 Miles.

An electric launch of 120 horse power which, it is expected, will attain a speed of 30 miles an hour, has just been completed by a resident of Buffalo, N. Y. Skimming through the water as it does with the speed of a motor car on the boulevards, this remarkable boat might well be called "the Automobile of the Lakes." Indeed the boat's mechanism is not altogether unlike that of the modern gasoline automobile and she is just as graceful and handsome in appearance and far more comfortable when in motion.

The boat was especially designed both in hull and engines for a higher speed than has thus far been attained by any American gasoline launch. What she is capable of doing when at her best is not yet known.

The Automobile Review says: "In her early trials on the river, which is narrow and shallow she made a speed of 23 miles and considerably better is expected when she is in her best condition. The hull is 55 feet over all by 8 feet breadth, and the engine has eight cylinders, giving 120 horse power. The launch was built at Brewston, on Onondago lake."

CURED BY POWERFUL ELECTRIC LIGHTS.

From all parts of the world lupus patients—persons suffering from tuberculosis of the skin—go to Finsen's institute in Denmark to be cured. The cures effected here are marvelous. Men, women and children who enter with loathsome and unsightly eruptions of the skin, cancerous forms of consumption, depart often without a scar to mark where the disease was located. Despite the protests of the residents the institute is located in the very heart of the fashionable district of Copenhagen. It was built by the kingdom of Denmark. The costs for treatment are: Danes $18 per month; foreigners $30 per month. A Dane who hasn't the means may have his expenses defrayed by the district from which he comes.

Electric light is the secret of the marvelous cures. A contributor to the Journal of the American Medical Association says:

"In the amphitheatre you are at once enveloped in an intense red glare coming from the electric globes. There are six 22,000-candle-power arc lights shaded with red paper. They remind you very much of piano lamps. About each light patients recline, each upon an elevated couch. The light is so glaring that patients and nurses have to wear dark glasses. Each patient requires a separate nurse, for it is necessary to hold continually a disc firmly pressed against the face through which the light is projected. The tubes that direct the light upon the affected surface look very much like telescopes. The purpose of the telescopic arrangement is that all the heat rays shall be eliminated and only the chemical, consisting of blue, violet and ultra-violet allowed to pass on. For it appears that they alone possess the bacterial power. The exclusion of the yellow and red rays is effected by an ingenious combination of lenses together with the assistance of water. The treatment consumes one hour. The power house which furnishes the lights is in the basement immediately beneath the operating room."

DEVICE TO CLEAN ASPHALT STREETS

Street Commissioner Woodbury of New York finds that a deluge of water will not produce a slippery surface on an asphalt street if the street be first cleaned of dirt. He has built for cleaning the streets a "squeegee," a board with a rubber veil, such as sailors have used for generations in cleaning ships' decks, only the commissioner draws his by horses.

MONROE DOCTRINE IS THREATENED.

Dewey With a Fleet of Forty Powerful Vessels in the Caribbean Awaiting Developments.

Combined forces of Germany and Great Britain have seized the Venezuelan fleet to test the Monroe doctrine, and Admiral Dewey, with a fleet of 40 powerful war vessels, including battleships, cruisers, gunboats, and torpedo boats, is quietly floating about in the Caribbean Sea awaiting developments. The movement of the world's two most powerful marine nations simultaneously and conjointly against the weak, poverty-stricken, war-ridden little nation of Venezuela was intended for a far more important purpose than the collection of the insignificant sum of $64,000 owed to subjects of the two nations, and of this fact President Roosevelt is aware. The claims of the two nations are entirely separate and bear no relation one to the other; yet Germany and England had to combine fleets for the purpose of enforcing the collection. The real object of the combination, of course, was for the purpose of intimidating the United States. It was thought that Uncle Sam would be a little loth to assert himself in opposition to two such powerful maritime nations. It is all a well concocted, deep-laid plan

The Gibraltar of the Caribbean Sea.—Inter Ocean.

worked out after mature deliberation. It was born of the kaiser's desire to secure a foothold in South America regardless of the Monroe doctrine, and of England's itching palm and disposition to "butt in" wherever there is hope of gaining territory. The plan was discussed and decided on by Kaiser Wilhelm and King Edward VII during the kaiser's recent visit to London.

The Monroe doctrine declares that no European power shall extend its territorial possessions on the American continent, nor attempt to oppress or contrive in any manner to control the destiny of governments whose independence has been acknowledged by the United States.

And Admiral Dewey is down there in the Caribbean, not many miles away from the scene of hostilities, to see that the doctrine holds good. Deep down in the bottom of the tepid oceans there now repose many shattered wrecks of once noble vessels that have been dashed to destruction against this animated rock of the tropical seas.

Electricity on the elevated roads in New York has thrown out of service 325 small locomotives which cost over $2,000,000. They will be sold cheap and bought by lumbermen and for switching about factory yards, etc.

Oil Stones and How They Are Made

Best Stones of the Present Day Dug from the Ozark Mountains in Arkansas

Since the use of sharp-edged tools began, stones have been used for sharpening them. Even before steel came into use the stone axe-heads, spears-heads and arrow-points were ground down by other stones. The word "whet," as referring to the sharpening of swords and iron tools, occurs several times in the Bible. Pliny, more than 1,800 years ago, tells us that the best whetstones used in those days came from Crete. This is probably the well-known Turkey stone that is yet used extensively.

The best natural stones of the present day are the Arkansas and Washita. Both come from the Ozark mountains, near Hot Springs, Ark. They are expensive, the rough rock as it is dug from the quarries often selling as high as $2 per pound. This same stone was used extensively by the Indians hundreds of years before the advent of the white man for the making of axes, arrow heads, stone knives, etc.

The manufacture of oil stones in this day furnishes the nucleus for an extensive American enterprise known as the Pike Manufacturing company. This company has just established a large factory at Littleton, N. H., about 30 miles from their scythestone plant at Pike Station. It is the largest oil stone plant in the world. What is known under the general term of oil stones are divided into two clases, the oil stones proper and scythestones. We will first describe the manufacture of oil stones.

The quarrying process is a difficult and expensive one, for not only is the good rock very scarce (found usually in small pockets), but its hard and brittle nature renders it impracticable to use dynamite or other explosives in any large quantity. It is therefore necessary to dig a channel through the rock by picks and steel chisels, or drills, then pry the rock loose in small pieces. This necessitates a great waste. Over 75 per cent of the Washita rock and more than 95 per cent of the Arkansas rock is wasted at the quarries.

The rough rocks are first sawed into slabs under large gang saws. The sawing material is sharp quartz sand and crushed steel, fed on to the saws by automatic sand feeds. The slabs are cut into strips of required width under a second set of saws a little smaller than the first and are finally cut into required thicknesses and lengths by a third set of gang saws.

From the saws the stones are taken to large cast-iron plates called rubbing beds, where they are shaped and smoothed by the use of a very fine grade of sand. They are then passed through several baths for the purpose of removing any stains left by the sawing or rubbing process into a dry room, where they are subjected to a high temperature until thoroughly dried and then passed on to the assorting room. Here the different grades are very carefully separated by skilled and expert workmen.

The Arkansas oilstone is so hard that the saws when fed with the sharpest sand, cut it at the slow rate of about three-fourths of an inch in 12 hours running continuously. It requires about three weeks to cut a gang bed of rough rock into slabs. About 40 per cent of the Washita rock and something like 60 per cent of the Arkansas rock is wasted in the process of manufacture.

A Washita Stone Quarry in the Ozarks Near Hot Springs

The manufacture of scythestones will be described in the next issue.

SYME, THE INVENTOR OF WATERPROOF.

The real inventor of waterproof was not Mackintosh of Glasgow, as is generally supposed, but Syme, the great Edinburg surgeon. In 1818 Syme published an article in the Annals of Philosophy announcing his discovery of benzine and its solvent power of caoutchouc. Having dissolved the rubber Prof. Syme relates that he rendered various textures (such as a silk cloak) waterproof by brushing with a thin solution.

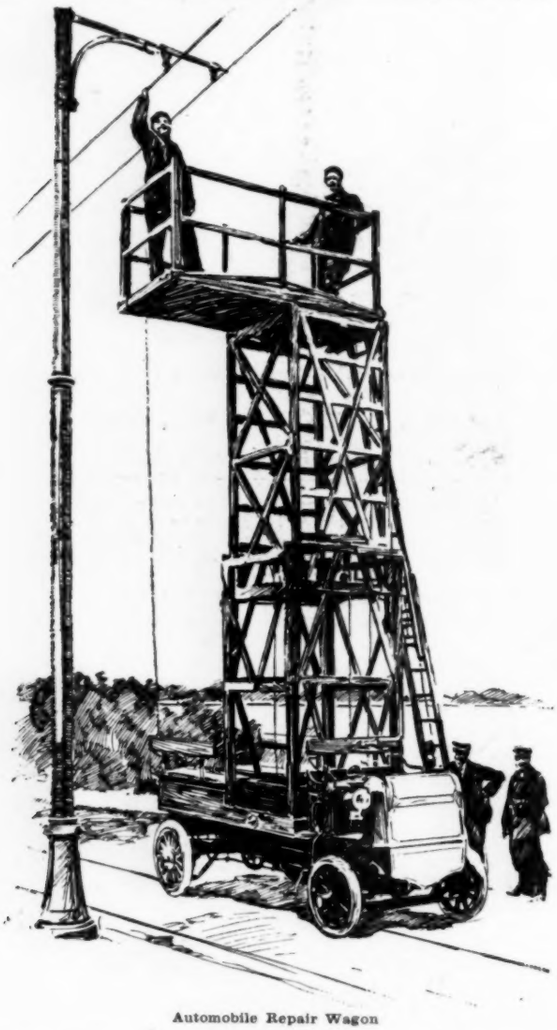
Where Oil Stones are Made

Kerosene will remove rust and finger stains from almost every kind of goods without injuring the facric. Wash the soiled spot in kerosene before the fabric has been put in soap and water.

Popular Mechanics "Tells you how to do things."

AUTOMOBILE TO REPAIR TROLLEY LINES.

The queerest looking automobile ever constructed may be seen hurrying along the streets of Paris, when anything breaks down on the trolley road. At such times it rushes along at 13 miles an hour, but when going over the road for inspection purposes



Automobile Repair Wagon

only half this speed is made. It can travel faster than the repair wagons drawn by horses, and is already doing the work of two-horse equipments. The tower is let down when making a run, to half the height shown in the cut. The Motor Age says: The automobile cost $2,500, will carry six men and 3,000 pounds of material, and will run 90 miles a day with its 12-horse-power gasoline engine.

LIFE SAVED BY MOTOR BICYCLE.

A physician in a small English town, being called upon to attend a patient with a serious case of lockjaw, found that the necessary serum for use in the case could not be obtained from the local drug store, says the Motor Age. To get it from the nearest supply depot, which was nearly 60 miles away, the train connections would take at least 15 hours, while 10 hours at the extreme would mean certain death for the patient, if the serum could not be obtained. A friend of the doctor, who owned a motor bicycle, volunteered to go for the medicine, and made the round trip in 6¼ hours, the patient's life being saved thereby.

Celluloid collars and cuffs should be cleansed with an ink eraser and then they can scarcely be distinguished from linen.

FACTS ABOUT THE SOUTH.

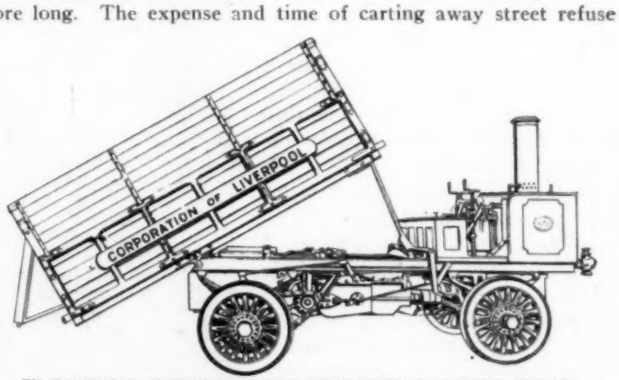
"Facts About the South" is the title of a most interesting and valuable pamphlet of 40 pages written by Richard H. Edmonds, editor of the Manufacturers' Record. It covers all the Southern resources, natural and industrial, and contains a world of information. He says:

"The South of today is no novel creation. It is the result of an evolution. After suffering and prostration it has been relieved of its great incubus and is becoming more and more able to hold its own with other sections in trade and manufacturing. There is a new South with many of the virtues of the old, free from some of its drawbacks. It is looking to the future; it is likely to make mistakes occasionally, but it will not be saved from them by those persons, on the one hand, who would contend that the old South was an absolutely ideal State, or by those, on the other, who would divorce progress from virtue, patriotism and integrity. The greatness of the old South will be the more esteemed as the new South reveals its lineage in the happy solution of problems hardly conceived two generations ago.

"It needs but little investigation to show that prior to the war the South was fully abreast of the times in all business interests, and that the wonderful industrial growth which it has made since 1880 has been due mainly to Southern men and Southern money. The South heartily welcomes the investment of outside capital and the immigration of all good people, regardless of their political predilections, but it insists that it shall receive from the world the measure of credit to which it is entitled for the accomplishments of its own people. In the rehabilitation of the South after the war Southern men led the way. Out of the darkness that enveloped this section until 1876 they blazed the path to prosperity. They built cotton mills and iron furnaces and demonstrated the profitableness of these enterprises."

CITY OF LIVERPOOL USES AUTOMOBILES IN STREET CLEANING.

England is away ahead of America when it comes to automobile wagons for heavy work. In Nottinghamshire alone there are 348 heavy freight automobiles, and now the city of Liverpool is using motor vehicles in its street cleaning department. These wagons are known as "tip-wagons," a type common over there but as yet unknown here. The wagon box holds six cubic yards —a large load—and can be dumped from either side of the wagon by one operator moving a small lever which causes the machinery to do the work. New York City is about to adopt the same kind of wagons in its street cleaning department, and other American cities may be expected to have tip-wagons before long. The expense and time of carting away street refuse

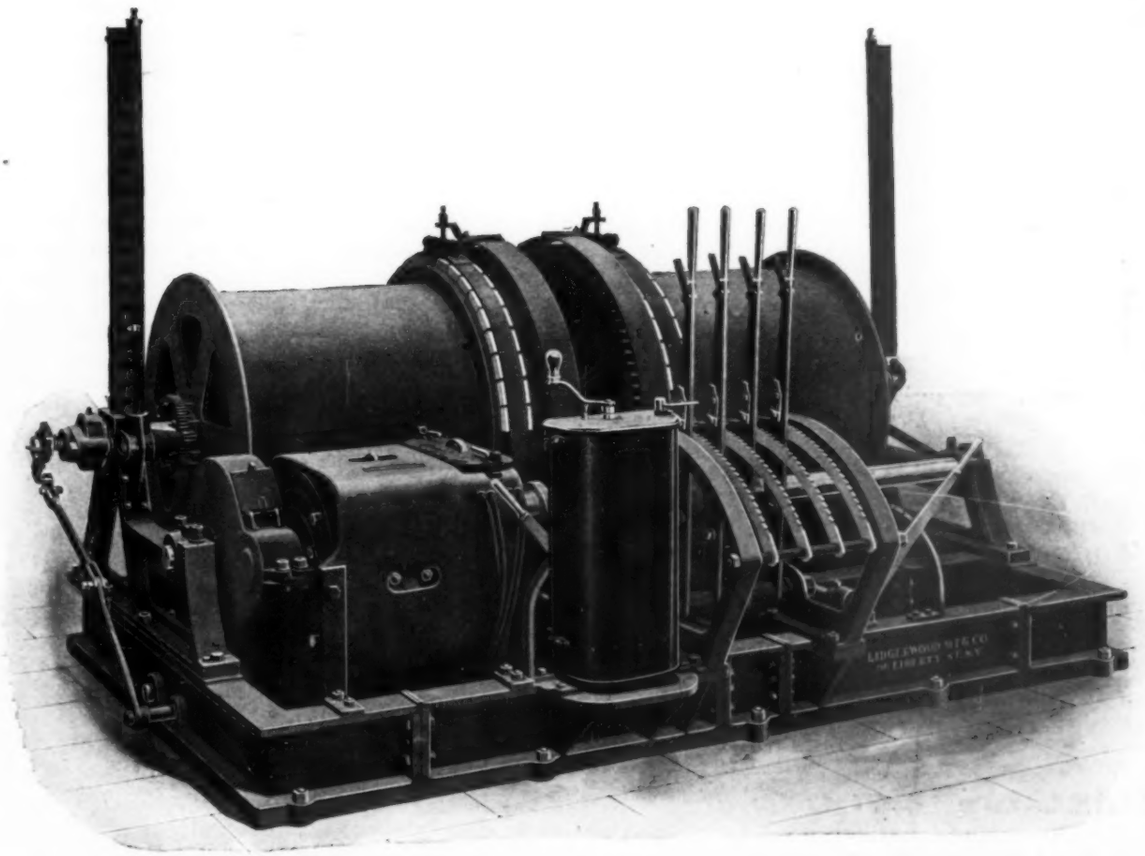


TIP WAGON USED BY STREET CLEANING DEPARTMENT OF LIVERPOOL, ENGLAND.

is reduced fully one-half by this mechanical system. The Automobile Review says these wagons will displace 1,800 horses in New York City alone.

Melted alum makes a good cement for uniting glass to metal. Melt it over the fire in an iron spoon.

Electric Hoists and Their Uses--Part II



DOUBLE FRICTION DRUM BALANCED ELECTRIC MINE HOIST.—This type of hoist is very simple, compact and efficient. The drums are narrow and each connected to a separate central gear wheel. Each drum is fitted with a differential band brake and the Hoist is well adapted to a double compartment shaft, double track incline, or tail rope haulage system. The friction brake and reversing levers are assembled in a rack at the front of the hoist. Both drums are loose on the shaft and independent of each other, so that they may be operated independently or be thrown into gear and a double compartment shaft operated, one cage going up while the other goes down. The advantage of this hoist for the tail rope system is obvious; as one drum being thrown into gear, winds up the main rope, the other drum being out of gear (loose on the shaft) pays out the tail rope. By reversing the motor the tail rope is wound up and the main rope paid out. The hoist operates with the minimum amount of friction and wear on the gears.

WIRELESS ELECTRIC TRAINS AND STEAMSHIPS COMING.

Nicola Tesla Proposes to Draw Power From the Air To Transport Passengers Over Sea and Land.

By Nicola Tesla.

Editor's note—Mr. Tesla has been working for more than three years on the transmission of electrical energy without wires. By the invention he has completed, it is claimed, he will be able not only to send messages for thousands of miles without wires but to send ocean liners to Europe and have railroads carry passengers 100 miles an hour by drawing their power from the air. Mr. Tesla has completed a large power house at Wardenclyffe, Long Island, and is building others in different parts of the country and one in Scotland, between which he proposes to send electric current of sufficient voltage to enable steamships and railroads to draw all their power.

By means of the current which will be sent between the different stations I will be able to draw power for almost any purpose. That I will be enabled to get force from which to operate railroads and steamships from currents passing through the air between power houses is an assured fact. All my experiments so far have proved successful and I am now devoting all my time toward getting things on a working basis.

I have been taking out patents on my inventions on the transmission of electrical energy without wires for the last three years. The whole idea in a nutshell is simply an extension of the plans to send wireless telegraph messages.

We have been sending wireless messages for long distances from the Wardenclyffe station for some time, but as to whether we are going into the telegraph field on a commercial basis I cannot say at present.

CHANGES ALTERNATING INTO DIRECT CURRENT.

A device for changing an alternating into a direct current has been invented by Profs. C. F. Burgess and C. Hambuechen of the University of Wisconsin at Madison, Wis. It is called an electrolytic rectifier and consists of aluminum and iron plates placed in a bath of fused sodium nitrate. It can be used in charging storage batteries in automobiles and other electric vehicles. It will be a great saving in the cost of charging automobiles, as at present both dynamo and motor are required, and the apparatus in use weighs almost ten times as much as the device perfected by the Wisconsin professors.

Before using a furniture cream wring out a cloth from very hot water and rub it over the furniture. Then apply the cream and a very high polish will obtain which will not fingermark.

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This Issue 18,000 Copies

Following is the record of new yearly paid subscribers received by POPULAR MECHANICS during the past month:

WEEK ENDING NOVEMBER	8	.....	886
" " "	15	.....	907
" " "	22	.....	929
" " "	29	.....	859
" " DECEMBER	6	.....	1,054

Advertisers are invited to examine our books at any time. We tell the exact truth about our circulation and have nothing to cover up.

HOW SLAG CEMENT IS MADE.

By Edwin C. Eckel, United States Geological Survey.

Six or eight plants are at present engaged in the manufacture of slag cement in the United States, the product for 1901 being 272,689 barrels. As slags, cooled slowly, are only feebly hydraulic, the slag used in the manufacture of slag cement, must be cooled as suddenly as possible. This is done by bringing the slag, as it issues from the furnace, in contact with a jet of cold water. This granulates the slag, renders it strongly hydraulic and removes most of the sulphur.

Two plants are engaged in the manufacture of portland cement from slag and limestone in the United States. In England, blast furnace slag has been somewhat largely employed as an adulterant of portland cement.

Slag, run into molds on issuing from the furnace, furnishes blocks which have been used for paving, notably in Philadelphia. These slag blocks are very durable, but objectionable because of their slipperiness, which in English practice has been overcome by the form of the mold used.

To remove ink stains from boards apply strong vinegar or salt of lemon. If this fails scour the boards with sand wet with water in which a few drops of oil of vitriol are mixed; then rinse with strong soda water. Do not touch the vitriol, for it is a corrosive poison.

ABATEMENT OF SMOKE NUISANCE IN BERLIN.

Skilled Firemen, Scientific Construction of Boilers and Chimneys and Good Fuel Solve the Problem.

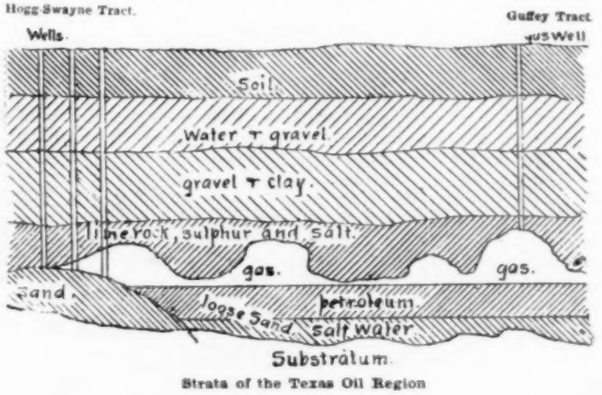
By Frank H. Mason, United States Consul General at Berlin.

One of the first things usually noticed by an American traveler visiting the German capitol for the first time is the absence of that cloud of smoke which overhangs so many towns and cities in our country. The reason for this lies in three facts: The preponderant use of coke and briquettes, which are practically smokeless; skillful and scientific construction of boiler furnaces and chimneys; and, finally, the high standard of skill that is taught and enforced among firemen who stoke furnaces with coal for steam and manufacturing purposes. It is not every strapping laborer who can shovel coal who is permitted to stoke a boiler furnace in this country. Before he can assume such a charge, he must be taught the theory and practice of economical, scientific firing, by which the coal is distributed in such manner and quantity over the grate surface as to secure the most perfect combustion of its volatile elements. The Silesian coal used here in most large steam plants and factories is rich in bitumen and would rank below many of the bituminous coals of the United States, and yet the long, dense, trailing clouds of smoke from mill and factory chimneys which are so familiar a sight in many American cities are rarely seen in this section of Germany, where the indiscriminate shoveling of raw bituminous coal into the steam and other furnaces is considered an ignorant and wasteful proceeding.

Coke making in retort ovens, by which every element is saved and bituminous coal converted into smokeless coke and gas, is another important factor in German fuel economy and abatement of the smoke nuisance. If American municipalities beyond the economic range of anthracite are ever emancipated from their present vassalage to the smoke incubus, it will be through the enforced use of one or more of three forms of prepared fuel, viz., coke and fuel gas made in closed ovens from bituminous coal, and briquettes made from lignite, peat, and other inferior materials by processes which have been invented, tested, and proven to be efficient by the older and more economical countries of Europe.

THE UNDERGROUND WORLD IN TEXAS OIL FIELDS.

From drillings made for several hundred oil wells in the Beaumont district, a map of the underlying layers of rock and earth has been made. A writer in the Manufacturers' Record says the choking up of wells is caused by the movement of loose sand forced by great pressure of gas into the bottom of the wells. This also explains why some of the wells spout salt water at times.



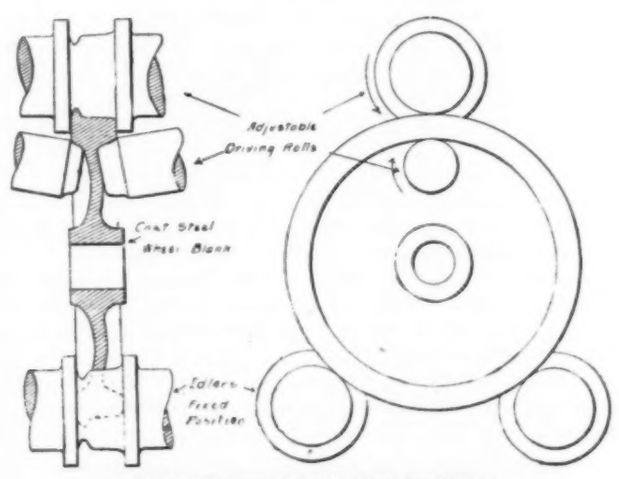
Strata of the Texas Oil Region

INVENTS WIRELESS PIANO.

Ira F. Gilmore, Bloomington, Ill., has taken out patents on a wireless piano. He has worked and experimented under many disadvantages the past thirteen years on his device. In the beginning of his venture he tried first in the United States to get his reeds made and failed, so he went to work on a piece of steel one-quarter of an inch thick and six inches wide, drilled it and filed until he had made a five-octave comb reed and placed it on a bridge and sound board. Then he picked it and hammered it and found he had discovered a way to make a very fine harp tone, which has been eagerly sought after for many years by all who tried to improve the tone in the wire piano.

HOW STEEL CAR WHEELS ARE ROLLED.

Railroad men are taking much interest in a new car wheel made of rolled steel instead of being cast and chilled to harden the wearing surface. Greater strength, elasticity, and safety is claimed for the rolled wheel. The first experiments were made in 1878, but with rather unsatisfactory results. Later attempts with improved processes of manufacture have produced wheels



Showing Process of Rolling Steel Car Wheels

which have made 800,000 miles as against 60,000 miles for the cast wheels. By the latest process the wheel is first cast, then reheated and passed through rolls, as shown in the cut.

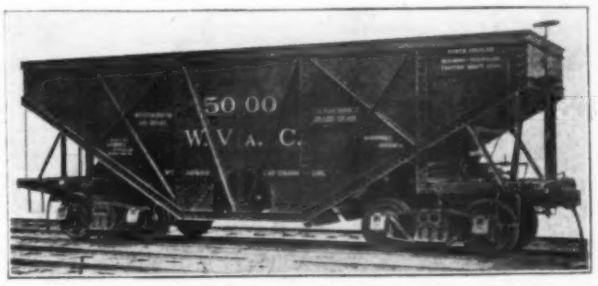
GREAT ELECTRIC POWER SYSTEM FOR SCOTLAND.

Three Hundred Factories Will Employ Electrical Energy Transmitted by Wire From Coal Mines.

While engineers in this country have been advocating the generation of electric power at coal mines and its transmission on wires to surrounding cities, the electricians of Scotland have completed plans for a gigantic installation of the plan. Seven hundred square miles of manufacturing district near Glasgow, containing more than 1,200 factories, are to be furnished with electric power. Already 300 establishments have applied for electric current to run their machinery. Three immense power plants will be erected at the mouth of coal mines and the current distributed in all directions. The business part of Scotland will thus be given cheap power with which to compete with the most favored in other lands, even those using water power. Generating stations will be erected at Motherwell, Yoker and Crookston, with wires extending out 16 miles in all directions from each plant. Several million dollars will be expended and the new English factory of the Westinghouse company will build the machinery.

THE VANDERBILT STEEL DUMPING CAR.

Conelius Vanderbilt has designed a car for the transportation of coal or similar freight, and 300 of these cars are being built.



Vanderbilt Coal Car

Steel is the material used and the car is 30 feet long and 8 feet wide inside. The car will carry 60 tons. The illustration gives an excellent idea of its appearance.

ANNUAL REPORT OF THE SMITHSONIAN INSTITUTION.

The last annual report of the Smithsonian Institute is a large and handsome volume and one of the best issued in many years.

"Bodies Smaller than Atoms" is the title of an interesting paper, and as we read "The Laws of Nature," "The Greatest Flying Creature," and "The Fire Walk Cermony at Tahiti," we are reminded of the wide range of subjects included in the Report. Wireless telegraphy, transatlantic telephoning, and the telephonograph are discussed by experts in electrical progress. Attention ought also to be called to papers on utilization of the sun's energy, the Bogosloff volcanoes of Alaska, forest destruction, irrigation, the Children's Room at the Smithsonian, the submarine boat, a new African animal, pictures by prehistoric cave-dwellers in France, automobile races, the terrible lizards that once lived in America, and Mr. Thompson Seton's paper on the National Zoological Park at Washington.

The whole volume has been called "the best popular scientific annual published in the world."

The Smithsonian Reports are distributed by the Institution to libraries throughout the world; may be had by purchase at cost from the Superintendent of Documents, Washington City, and may also generally be obtained free of charge from the applicant's Member of Congress.

GUNBOATS FOR MEXICAN NAVY.

A pair of gunboats for the Mexican navy were launched last month at a shipyard in New Jersey. The vessels have steel hulls, are 200 feet in length and carry two masts, on one of which is

American Built Gunboat for Mexican Navy

mounted a strong electric searchlight. They will sail at 16 miles an hour and are equipped with all the latest improvements in steam and electrical machinery.

Two pieces of cork placed at the bottom edge of a picture frame, to keep it out from the wall, will keep dust from accumulating.

Remarkable Experiments with Gasoline--Part II

More Tests by Prof. Roberts to Prove the Substance Not Explosive

NOTE—Prof. Roberts' remarkable experiments with cans containing gasoline, to which he applied a lighted match and poured the gasoline through a flame from one can to another were described in the previous issue of Popular Mechanics.

By Prof. E. W. Roberts.

The ensuing illustrations show experiments made at the instance of the advisory editor of Marine Engineering, and are to disprove the popular superstition that a lighted cigarette or a lighted cigar will ignite gasoline or its vapor. In Fig. 4 is shown a lighted cigarette which was smoked furiously for a moment, in order to secure a very bright spark, and then held over

Fig. 4.—Holding a Lighted Cigarette Over Can Opening

the opening of the can. At the time the photograph was taken the cigarette had been held in the position shown for fully 15 seconds. The writer has tried this experiment a number of times, both in the manner shown and by holding a cigarette, or a cigar in an explosive mixture of gasoline and air. In no instance was it possible to secure ignition.

In Fig. 5 the writer is seemingly very brave, smoking a cigar at a rapid rate with the burning end held over the opening of the can. The ashes had been carefully knocked from the cigar, so as to give the vapor the greatest possible access to the burning tobacco. In the photograph the smoke issuing from the cigar is plainly visible, although the writer is uncertain whether it will reproduce in the half-tone.

In Fig. 6 the small cup is filled to the brim with gasoline, and the photograph is taken just as a brightly burning cigar is plunged therein. The result is exactly the same as if the cigar were to be plunged into water. The spark is extinguished with considerable sputter and the generation of quite an amount of vapor.

The cigar shown in Fig. 7 has first been lighted and then thoroughly saturated with gasoline. The cigar is a fresh one, yet the writer smoked it to within an inch of the end without a flame appearing, although the "snipe" contained a considerable quantity of gasoline, and immediately bursting into flame on attempting to relight it with a match. Perhaps this would not be a very pleasant experiment for the average individual, but the writer may say that he is quite accustomed to the taste of gasoline, and, with the exception of a possible slight tendency to light headedness, suffered no inconvenience whatever.

I have just received from Professor Durand a clipping containing an account of the recent explosion on the "Lucy R.," which the newspapers attributed to the tank taking fire from the spark of a cigar. This would seem a contradiction of the results obtained by the previous experiments, but the writer believes that, if the truth were to be told, the cause of the explosion was an entirely different one, and that this part of the story had its origin in the brain of the reporter.

This story reminds the writer of the explosion on the "Fulton" some two years ago on Long Island Sound. This explosion has been quoted by the manufacturers of an engine using kerosene as a fuel as a "new and disastrous proof of the exceeding danger accompanying the use of gasoline." In regard to this explosion a gentleman has written me as follows: "This explosion on the 'Fulton' was not due at all to gasoline, but to hydrogen gas originating from the storage battery." Incidentally it may be mentioned that the explosion on the "Fulton" was at the time attributed to a lighted cigarette. Although the writer has not had an opportunity to try a lighted cigarette on hydrogen, he does not believe that even this lightest of gases can be ignited in this manner. This opinion is founded upon the statement of Mr. Percival Spencer, of London, a balloonist, who has, in all probability, made more ascensions than any man living. In reply to a question propounded by the writer, he stated that, so long as a cigar had been lighted before entering the car of a balloon, there was no danger of igniting the gas from that source.

One often reads of a balloon exploding by catching fire. This is a popular fallacy, for, although several balloons have caught fire, there is no record of a balloon explosion following such a disaster. If the neck of a balloon is tied tight and it is sent to an extreme altitude, the rarefaction of the air will cause the balloon to explode simply on account of excessive pressure of the gas contained in the envelope. A conflagration, however, does not necessarily follow.

A parallel case to the above is found in a tightly closed vessel containing gasoline which is exposed to an excessively high temperature. The heat will generate vapor, just as steam is gen-

Smoking a Cigar over a Can Opening

erated in a boiler, and the vessel will explode in the same manner as the balloon, but unless a flame is in the immediate neighborhood the vapor will not take fire. As an instance the writer

remembers a benzine can which exploded in the above manner in a printing office, but no fire followed.

Many so-called gasoline explosions are really nothing more than gasoline fires, starting usually with a receptacle catching fire and then being upset by some excited person. Nevertheless it is quite possible to produce a gasoline explosion, as the following instance will illustrate: In the factory where the writer is employed a workman was testing out a gasoline tank with water. No gasoline had been in the tank for ten days, except what little remained after the tank was emptied. Wishing to solder the tank, the workman stepped to the forge to dry it. In a moment there was an explosion; the tank was flattened out, but, fortunately, the workman escaped injury. As it requires but 124 volumes of gasoline to 1,000,000 volumes of air to make an explosive mixture, it will be seen that a gasoline tank must be nearly dry to contain an explosive mixture.

In a boat driven by a gasoline engine precautions should be taken to avoid leaks into the locker spaces and all enclosures where a very small quantity of gasoline is likely to become mixed with a large proportion of air. If the engine room is inclosed it should be well ventilated, as should the space around the gasoline tank and all spaces where gasoline is likely to enter. Gasoline should be led from the tank to the engine through a lead pipe, all joints of which should be sweat joints, well made. Besides the convenience of lead pipe for passing around corners, it is not so likely to spring a leak as other materials when it is subject to strain or some heavy object is dropped upon it. If a leak is found, stop it absolutely, as a leak partially stopped is very likely to be worse than if it had been left alone; for a small quantity of gasoline is more likely to cause an explosion than a large one.

If, by any mischance, gasoline takes fire and a fire hose is available, use it so as to wash the burning gasoline into the sea, and get away from that portion of the water on which lies the burning gasoline. This should never be done, however, if the burning gasoline is liable to be carried on top of the water to other inflammable property, unless it is absolutely necessary to save life. A gasoline fire of small proportions may be beaten out with a blanket or a coat, but a much better extinguisher is flour, which will float on top of the liquid and smother the flame. Sand

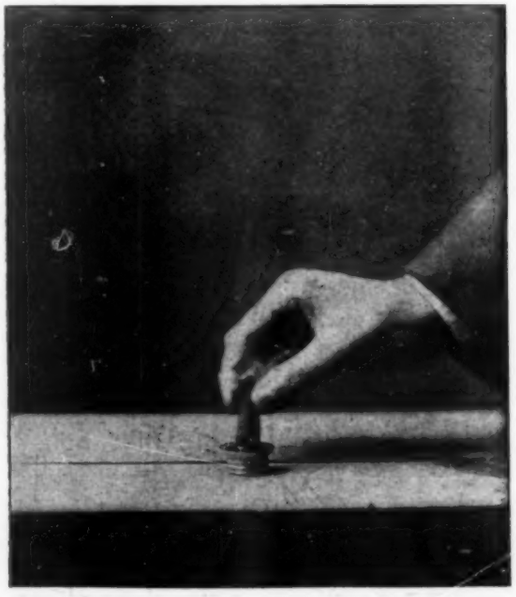


Fig. 6.—Digging a Brightly Burning Cigar into Gasoline

or loose earth will also answer the purpose, but, as it sinks to the bottom of the liquor, it is not quite so good as flour. A bottle of strong ammonia thrown into an inclosure in which gasoline is burning, or in fact any fire, will often prove a very effective extinguisher. Chemical fire extinguishers are also much better than water, and they should be invariably carried in a gasoline launch of any proportions.

In conclusion, the writer would say that the so-called dangerous properties of gasoline are to a great extent purely imaginary and have no existence in fact. With ordinary care a gasoline engine is not nearly so dangerous as a steam boiler, and does not require nearly the attention necessary in the care of the

Fig. 7.—Smoking a Gasoline Soaked Cigar

latter to prevent accident. This statement is amply verified by the exceedingly small number of accidents that have occurred to the power plants of gasoline boats from the gasoline itself.

IRON CHAIN BRIDGE BUILT A CENTURY AGO.

Spanned a Creek in Western Pennsylvania and Was the First in America.

More than a century ago an iron bridge spanned a stream in Western Pennsylvania. It was across Jacob's creek and was the first iron bridge built in America. It was a chain bridge, the span being supported by two iron chains extending over four piers, 14 feet higher than the bridge, fastened in the ground at the ends, describing a curve line touching the level of the bridge in the center. The structure was completed May 22, 1802. The first tier of joists were hung to the chains by iron pendants or stirrups of different lengths so as to form a level of the whole. The bridge was of 70 feet span and 13 feet wide; the chains were of an inch square bar in links from 5 to 10 feet long. It was built by Judge Finley of Greensburg, Pa. In 1810 eight bridges had been built on Judge Finley's plans. There was one at Schuylkill Falls above Philadelphia; one at Cumberland, Md.; another over the Potomac above Georgtown, Md.; another over the Brandywine at Wilmington, Del.; one at Brownsville, Fayette county, Pa., a similar bridge near Brownsville and one over the Merrimac, three miles from Newburyport, Mass.

The deepest mine shaft in the United States is the Calumet & Hecla—4,900 feet. The deepest hole drilled in the United States is the oil well of the Forest Oil Co., West Elizabeth, Allegheny county, Pa.—5,575 feet.

LOCOMOTIVES OF THE FUTURE.

As told in our history of "Locomotives of a Century," the size of locomotives is being increased to such an enormous extent that their weight is gauged only by the capacity of rails and bridges to sustain them. Heavier locomotives will necessitate stronger rails and bridges.

There will be a battle royal sooner than many expect. The improvement of the locomotive will embrace the further development of those features invented in the previous century. Compounding of all locomotives upon some system now used, or yet to be invented, will be almost universal. The wide fire box and tubular boiler will be carried to the limit of human ability to manage it. This will give place to the water tube boiler, especially for high speeds. Who is destined to be the instrument of its introduction? Already bright minds are employed in designing a boiler of this description, which can be placed on our arrangement of cylinders, underframing, wheels and machinery, a system that will give three times the heating surface for an equivalent weight. Higher pressure will then be common and we all may live to see triple and even quadruple expansion locomotives almost noiselessly performing their work. High speeds, consistent with safety, will be used for all trains carrying human freight, but long and heavy express trains will be handled with facility by the improved high pressure compound locomotives of that period. The loading gauge of our trunk lines will not prevent doubling, or even trebling the power of locomotives for freight traffic. A double bogie engine, similar to those used abroad, but on the American idea, will be employed, thus reducing it to an almost perpetual operating machine, any part of which can be removed in a short time and a duplicate substituted.

Fig. 1.—Modern Tile Fireproof Elevator

WORLD'S LARGEST OFFICE BUILDING.

The largest office building in the world is the Broad Exchange, on the southeast corner of Broad and Exchange Place, New York. It rises twenty stories high over 27,000 square feet of ground, and cost $7,500,000, although it has no ornamentation.

The latest Hoe printing press uses up 120 miles of white paper every hour it runs.

BRIDGE TRAMWAYS FOR HANDLING COAL.

The exigencies of handling great quantities of coal for shipment have produced bridge tramways for both loading and unloading of fuel. In the case of anthracite coal, clam-shell buckets and bucket shovels which scoop up the coal have been introduced in connection with the bridge tramway instead of the ordinary bucket. One of them will take 400 tons of coal a day from a vessel and load it in cars 150 feet away.

GOVERNMENT TEST OF FOODS.

Experiments are to be made on twelve young men in the government employ at Washington to determine what grounds there are for Germany's objections to American meats on the claim that borax and other chemicals used in their preservation are injurious to health. Six of the young men will be fed on "pure" food, untreated meats and vegetables. The other six will be fed on the same food chemically treated.

BUILDING OF MODERN TILE, FIREPROOF ELEVATORS.

Largest Grain Storages in the World Built By the New Process.

A new age in elevator construction has resulted from the fireproof tile storage bins in the United States, the greatest elevator country in the world. The construction of these elevators, which are built of a combination of tile and reinforced steel members, was described in Popular Mechanics Nov. 15. Herewith

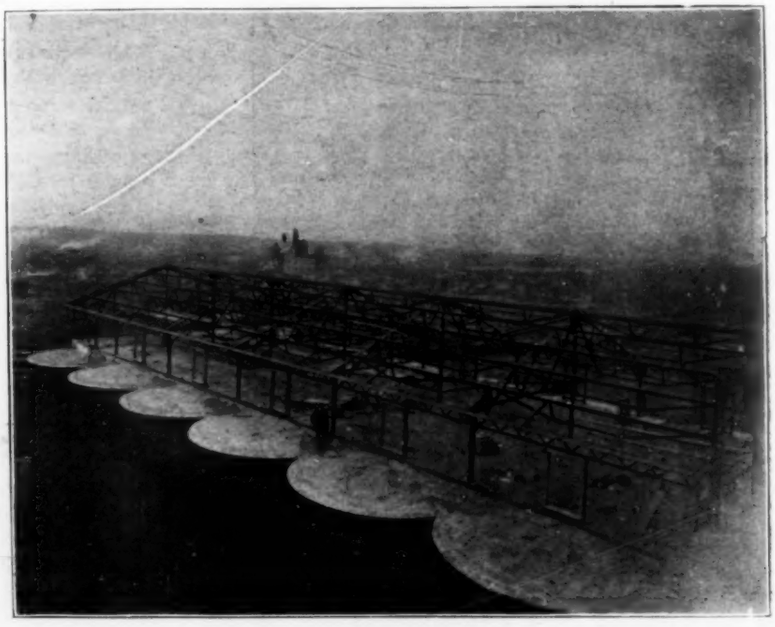


Fig. 2.—Steel Framework, North Star Malting Co.'s Plant

are shown other views that will aid in giving the reader an idea of their mechanism.

Fig. 1 is an exterior view of the North Star Malting Co.'s plant at Minneapolis. These tanks are built in three rows of six tanks each, thus giving two rows of intermediate bins and with steel working-house for the principal machinery. Fig. 2 shows the steel frame-work over the tanks. This frame-work, as shown, extends to the center line of the two outside rows of bins, thus forming a level floor between these two walls for the accommodation of the machinery.

Fig. 3 represents the boiler plant of the St. Anthony Elevator, Minneapolis, the largest fireproof elevator ever built. It is equipped with four 150 horse-power vertical boilers with dust collector attached. The dust is collected through this elevator and two other elevators adjoining and is discharged into the furnaces through the metal spouts as shown in the cut. Nine tanks of the Great Eastern Elevator company are shown in Fig. 4. The tanks are 46 feet diameter and 90 feet high, having a capacity of 100,000 bushels each. The large modern tanks recently built for the Appleton Brewing & Malting company, at Appleton, Wis., have contact sides, thus giving an intermediate bin. These tanks have a capacity of 30,000 bushels each and the intermediate space about one-fourth of the circular bins. The tanks of the St. Anthony elevator are 96 feet high, 50 feet diameter and each have a capacity of 125,000 bushels. This work was all done by the Barnett & Record Co. of Minneapolis.

The difference between a "rapid-fire" gun and a "machine" gun is that the former is loaded by hand.

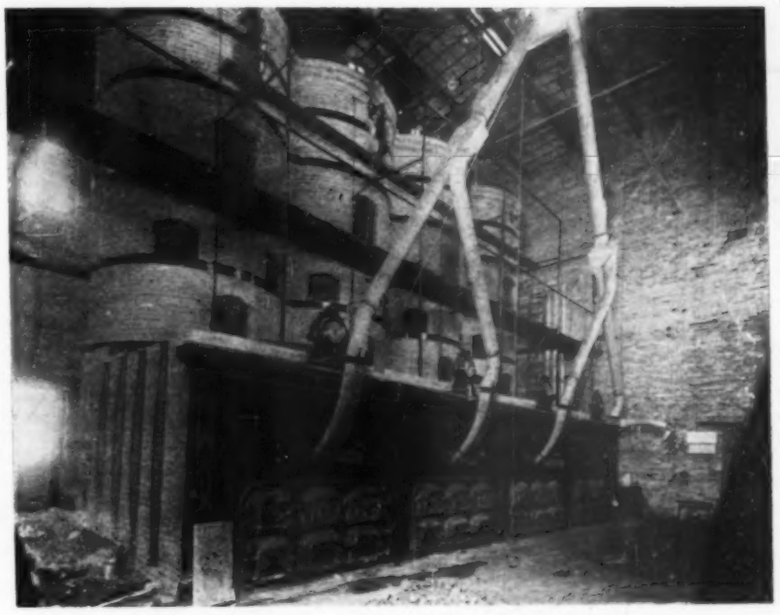


Fig. 3.—Boiler Plant of the World's Largest Fireproof Elevator

MUST HAVE ENORMOUS POWER.

The amount of engine power to be given the two new heavily subsidized Cunard steamers, which are expected to restore British prestige on the seas by outracing the German steamers which now hold the records, has not been announced. The Deutchland having developed 38,000-horse power and the Kaiser Wilhelm II., now building, being provided with engines more than 40,000-horse power, make it seem necessary to give 50,000-horse power to the Cunarders in order to assume victory.

Counterfeiters have flooded Chicago with spurious half dollars.

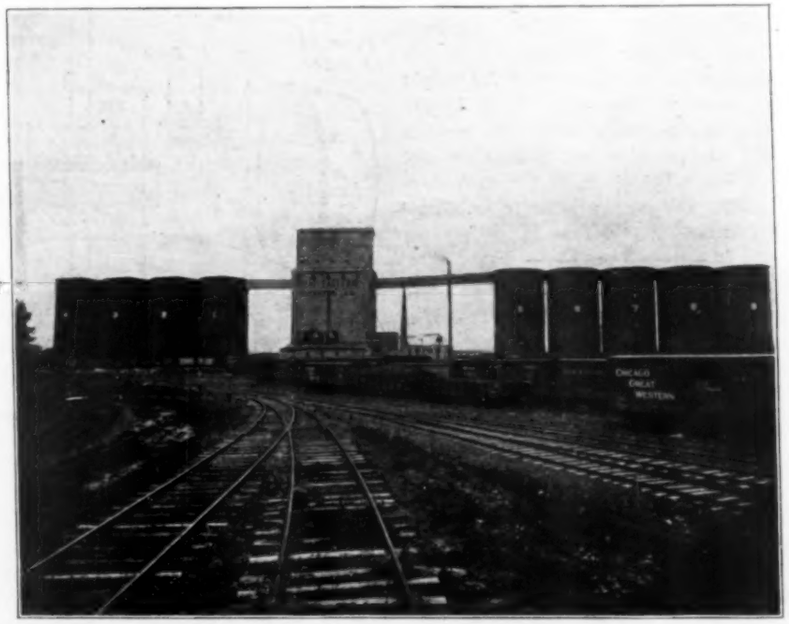


Fig. 4.—Tanks of the Great Eastern Elevator's Plant, Minneapolis

THE HEAVY GUN A MECHANICAL MARVEL.

If we go into a modern battleship and go over her, there are no places in her which would so fill us with wonder, and, it may be added, a certain amount of uneasiness, as her engine room and her gun turrets when in operation. In the latter, if she is a large ship, she will carry 12-inch or 13-inch guns, probably, and these, weighing from 50 to 60 tons—about the weight of a fair-sized locomotive—will, when they are fired, be projected to the rear at a rate of about 25 feet per second, or say 17 miles an hour, says Engineering Magazine. By their hydraulic recoil brakes, in which resistance to the motion of a piston in a fluid-filled cylinder, is by means of a rod utilized to restrain the gun's recoil, the gun will be stopped in about 36 inches, and will be returned to its firing position by a powerful coiled spring. So quick is the stroke or recoil and return that the eye fails to appreciate it, and devices are used in gun turrets to prevent the gun from being loaded twice, from a mistake on the part of the gunners in supposing that the gun had been fired when it had not. Nothing, perhaps, gives an idea of the immensity of the forces in play so well as the snapping of a 50-ton weight to the rear and forward again so quickly that the human eye can hardly see it. On land, again, we have the so-called disappearing mountings, on which a gun is carried on a pair of long rocking levers. Upon firing, the gun of 50 or 60 tons is dropped behind a parapet, and, upon throwing a lever, after the gun has been loaded in its lower position, the gun rises above the parapet again, and is once more ready to be fired.

SHOP NOTES

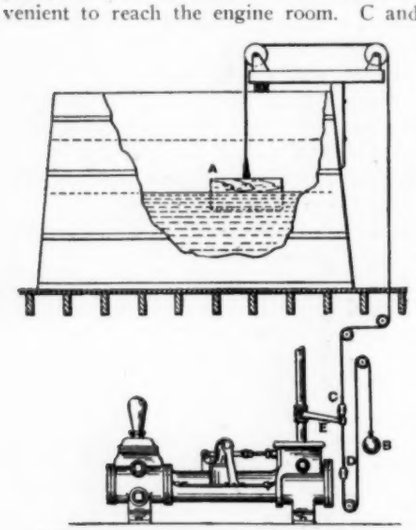
WATER LEVEL ALARMS.

Two devices for indicating low water level in storage tanks, are described in the Engineer. One is an electric signal system which almost anyone can construct from the following directions:

The signal system is arranged so that when the water reaches a certain height an electric bell will ring in the engine room, warning the engineer that the tank is full. This idea is illustrated in fig. 2.

A is a float, E is a weight to keep cord M taut, B and C are contact pieces of brass, and are connected to the wire J, which connects with the bell H. D is a contact piece clamped to the cord M, and connected to the wire K by the flexible cord I, which allows a free movement of the block D up and down, as the water rises and lowers. G is a plug switch, and F represents the batteries. When the water lowers, the float descends, causing the block D to ascend until it comes in contact with block B, which is stationary; this completes the circuit to the batteries and bell. When the tank is filling, the float ascends, and the block D descends until contact with block C is made, which again forms the circuit. The distance the water will rise and fall before the bell rings depends upon the distance blocks B and C are apart. When the pump is started the plug should be placed in the switch, and removed when the bell rings. This is a convenient arrangement, and one that will prevent trouble.

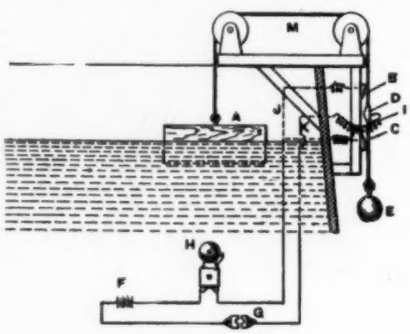
The other cut shows the governing arrangement of the pump. A is a float attached to a cord which is conducted over pulleys in such a manner as is most convenient to reach the engine room. C and



Regulating the Pump by a Float in the Tank

D are tappet blocks. B is a weight to keep the cord taut, and E is a lever attached to the stem of the valve on the steam pipe of the pump. As the water lowers the float A will also lower, causing tappet block D to rise until it strikes the lever E, forcing it up, and thereby opening the valve. The weight B should be heavy enough to bring the block C and lever E down until the valve is closed as the float rises.

When it is desirable to increase the capacity of a piping system it is well to



Low Water Electric Signal

remember that by doubling the diameter of a pipe, its capacity is quadrupled. The pressure on any part of a piping system supplied by a tank may be found by multiplying the distance in feet the pipe is from the water level of the tank by .434, because a column of water 1 foot high exerts a pressure of .434 pounds per square inch. For example, the diameter from a pipe system to the water level is 40 feet. Then 40 feet × .434 = 17.36 pounds per square inch. If the pressure per square inch is known, and he distance is required, multiply the gage pressure by 2.31, because the height of a column of fresh water that is equal to a pressure of 1 pound per square inch is 2.31 feet in height. Therefore, we have 17.36×2.31=40.1 feet in height.

Sometimes it is well to know the weight of the water in the tank. As a United States standard gallon weigh 8½ pounds, multiply the number of gallons in the tank by 8½. Therefore, if the tank contains 10,000 gallons, we have 10,000×8½= 85,000 pounds, or 42½ tons.

HOW TO WRITE INSCRIPTIONS ON METALS.

Take ½ oz. of nitric acid and 1 oz. of muriatic acid. Mix, shake well together, and it is ready for use. Cover the place you wish to mark with melted beeswax; when cold, write your inscription plainly in the wax clear to the metal with a sharp instrument; then apply the mixed acids with a feather, carefully filling each letter. Let it remain from 1 to 10 minutes, according to appearance desired; then throw on water, which stops the process and removes the wax.

MICROSCOPE TO DETERMINE HEAT IN STEEL MAKING.

The microscope is becoming of greater practical use every day. Formerly it was found only in laboratories where fly eyes and mosquito bills were made to look as large as saucers and anchors. Now it tells without any chance of mistake what disease you have, whether the drinking water is safe to use and countless other things we want to know.

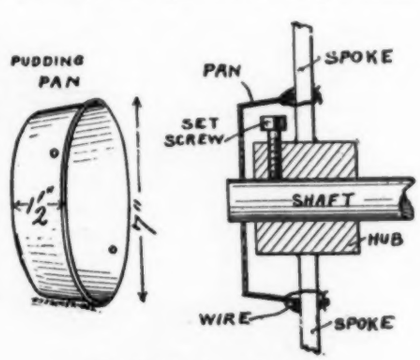
Prof. Sauveur of the Boston Testing Laboratories, has now discovered that an examination of a piece of steel by the microscope will determine the amount of heat necessary to bring the steel to any desired condition. He says: "The use of the microscope is a step far ahead of chemistry in determining the properties of steel, in that it penetrates the very soul, as it were, of this commodity and exposes its good and bad qualities. I would urge all of you to have the microscope used in your mills, as by its use you can determine beyond a doubt the proper heat to be used in making steel."

TIN PANS TO PROTECT SET SCREWS.

Here is another simple set screw protector to add to the list already given. A writer in the American Miller says:

"We use for a protector a tin pudding pan about 1½ inches deep by 7 inches in diameter, the size of course being governed somewhat by the length and diameter of the collar and set screw. We punch holes in the rim of the pan and fasten it to the arms of the pulley with wires. If a shaft projects beyond the collar cut a hole in the bottom of pan large enough to admit the shaft.

This does away with all danger of set



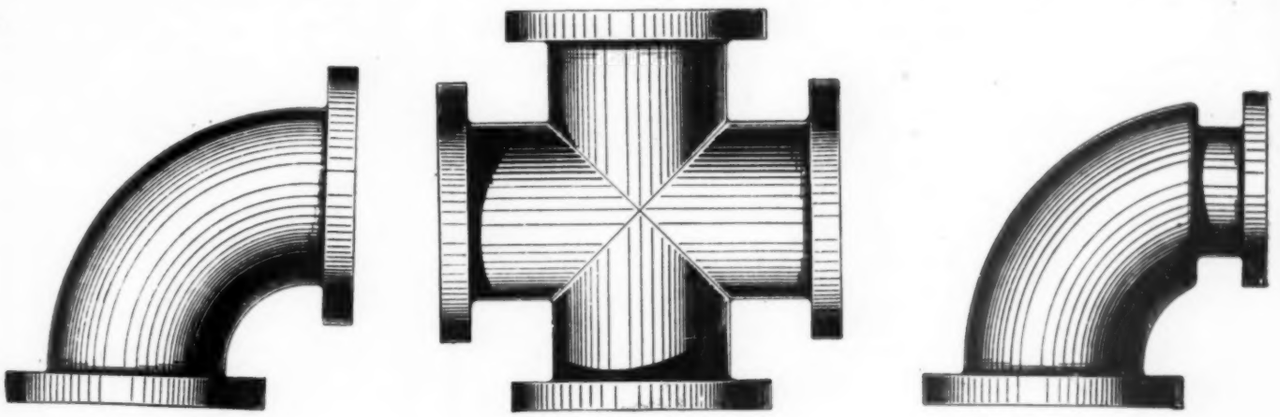
Tin Pan Set Screw Protector

screws and the cost is only about 4 cents per pulley. This device cannot be used on line shaft pulleys, but for roller pulleys it cannot be beat.

The efficiency of our new battleships will be about five times that of the best of them during the Spanish war and double that of the King Edward VII which is the most powerful foreign ship now in hand.

SHADING MARK ON DRAWINGS.

The appearance of a drawing is very greatly improved by adding the shading. Draftsmen generally concede that the light is supposed to come from the upper left hand corner which places the shading on the right and lower portions of the drawing. The illustrations give an excellent idea of how shading may be done on curved parts as compared with flat surfaces. The subjects selected are steam fittings.



Example of Shading Pipe Drawings

HOW AND WHY THE INJECTOR WORKS.

A. E. Rhodes in the Practical Engineer writes entertainingly of the injector. He says: The operation of the injector does not involve any principle of a perpetual motion, and is not doing work without consumption of power. Mr. Forney, in his book "Catechism of the Locomotive," states the principle in substantially these words: Steam escaping from under pressure has a much higher velocity than water would have under the same pressure and condition. The escaping steam from the receiving tube unites with the feed water in the combining tube, and gives to this water a velocity greater than it would have if escaping directly from the water space in the boiler. The power of this water to enter the boiler comes from its weight moving at the velocity acquired from the steam, and it is thus enabled to overcome the boiler pressure.

He then goes on to illustrate this by the example of a wooden croquet ball, which will float on the surface of the water, but if thrown violently into the water it will sink before its bouyancy will overcome its momentum, while a very light hollow ball will not sink, no matter how much force we may expend in throwing it into the water, because its momentum or actual energy is much less than is that of a solid ball. If steam were not condensed it would not have sufficient energy to overcome the boiler pressure.

Another writer, Sinclair, describes the principle very nicely in the following language:

The principle of the injector's action is that of induced currents. A current of any kind has a tendency to induce a movement in the same direction of any body it passes over or touches. Thus we are all familiar with the fact that a current of air (called wind) passing over the surface of a body of water, sets waves into motion.

In the same way a jet of steam moving rapidly when injected into a body of water, under favorable conditions, imparts a portion of its motion and starts momentum sufficient to overcome the original pressure of the steam. That is how the injector is made to force water into a boiler against the same pressure the steam is starting from. There are many other applications of this principle, the most common of which are: The ordinary locomotive blast, blowers, steam siphon, steam jets, jet exhausters and Argand burners.

Closely examined, its mystery as a source of power disappears; for it is found that an amount of heat equal to the mechanical equivalent work done is used up during the operation of feeding.

Thus, when a given quantity of heat units pass from the throttle to work the injector, the whole of the heat does not return to the boiler along with the feed water, as was at first supposed to be the case, but a portion of the heat representing the foot pounds of work done is dissipated, besides other losses due to leakage, radiation and connection.

There are many forms of injectors in use, but all of them conform to the above elementary principles in their mode of action.

In the cut, steam enters from the boiler, passes through the steam pipe and receiving tube S, at a high velocity and, combining with the water at point W, condenses, but imparts considerable momentum to the water which rushes along into the delivery pipe, raises the check-valve and passes into the boiler. As the current of water for starting the injector could not be induced against the constant pressure on the check-valve, which equals the pressure at the throttle, an overflow is provided, when the water can flow unchecked until the necessary momentum is obtained, when the overflow is closed.

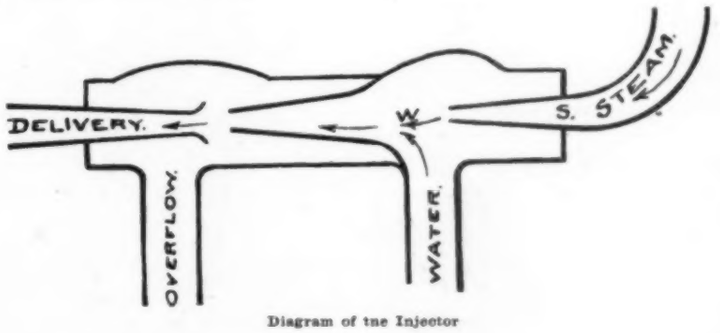


Diagram of the Injector

MACHINERY CREATES OCCUPATIONS.

A recent article in a British journal says: "The United States, like an enchanted garden, has brought forth from a marvelously productive soil, splendid results of human ingenuity. Yet the thing that causes most wonder is that the concentrated intelligence which, intending to replace human factors by machinery, has, in working towards its aim, been giving to constantly growing numbers of workmen an opportunity to support themselves and become productive factors."

"Honor and fame from no condition rise;
Act well your part, there all the honor lies."

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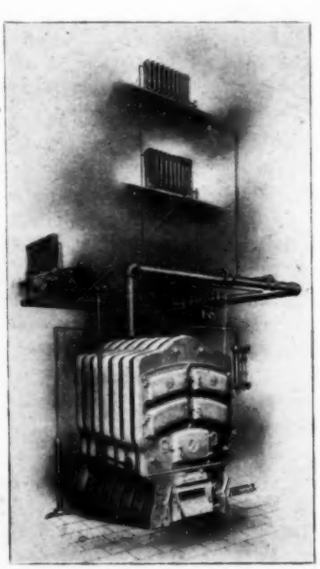

solves the problem of combined economy and convenience; perfect regulation of heat; absolute automation in operation and apparently does away with quite all the difficulties experienced with former methods. The best thing about the new system, however, is the low cost of its installation. To realize the comforts, economy and superior conveniences it provides, it is not necessary to have the old heater and pipes removed and entire new machinery put in, as might be supposed. The device is a simple appliance for expelling the air and preventing its return known as the Mercury seal, which can be used in connection with any steam heater or steam heating system. It is the invention of James A. Trane of the Vacuum Heating Co., 40 Dearborn street, Chicago, a lifelong student of hydraulics and aerodynamics. Its application is known as the Trane Gravity Vacuum System of Steam Heating. By the use of an ingenious automatic device, steam pressure is made to expel the air through the Mercury seal and condensation creates a vacuum. This is the basic principle of the whole device. The result is a wonderful economy of fuel and water. Under the old system a residence requiring 1,000 square feet of hot water radiation would have to be equipped with a plant necessitating about 700 gallons of water. By the Trane vacuum system such a building would require only about 650 feet of radiation and the plant less than 100 gallons of water. When the fire in the furnace burns low the water in the furnace being subject to a vacuum through the condensation of steam in the radiator, continues to boil. As the temperature of the water decreases the tendency to a vacuum increases and the mercury rises from the Mercury seal up into the air pipe so that it is not uncommon for the system to carry a vacuum of 20 inches when the water in the vacuum is boiling although the temperature of the water is but slightly above 160 degrees. Thus instead of burning the large amount of coal necessary to heat the water to 212 degrees, as is necessary with the common system of steam heating, the same amount of comfort may be realized from the Trane system by having sufficient heat to keep the water in the boiler at only 140 degrees. Its economy of fuel, however, is only one of the many advantages possessed by this unique system which seems o have for all time settled the question as to the ideal method of heating buildings.

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When pa firs' et tabasco sauce—I'm smilin' 'bout it yet,
Although his subsekent remarks I always shall regret.
We'd come to town to see the sights, an' pa remarked to me:
"We'll eat at a bong tong hotel an' sling some style," says he.
An' then he sort o' cast his eye among the plates an' all,
An' says, "That ketchup mus' be good, the bottle is so small";
An' then he took a piece o' meat an' covered it quite thick,
When pa firs' et tabasco sauce an' rose to make his kick.

It all comes back so plain to me; I rikollect it well;
He jest was talkin' mild an' calm, an' then he gave a yell
An' tried to cave the ceilin' by buttin' with his head,
"Er-hooh! Er-hooh! Fire! Murder! Hooh!" I can't tell all he said.
But when they heard his heated words six women left the room;
An' said such language filled their souls with shame an' also gloom;
But pa, he only gurgled some, and then he yelled again,
When firs' he et tabasco sauce an' told about it then.

An' pa, he sort o' gasped at first an' then he tried to smile,
An' says: "Just heat a poker, now, an' run it down my neck;
I want to cool off gradual, it's better, I expeck."
But when he'd got me out o' doors, he says: "I want to get
That there blame ketchup recipe an' learn jus' how it's het,
So I can try it on the boys when you an' me get hum,
Till they, too, think the condiment is mixed with Kingdom Come."

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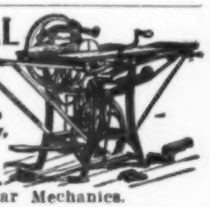

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